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ON THE VALIDITY OF THE INDO-PACIFIC CARDINALFISHES *APOGON AUREUS* (LACEPÈDE) AND *A. FLEURIEU* (LACEPÈDE), WITH DESCRIPTION OF A RELATED NEW SPECIES FROM THE RED SEA

John E. Randall, Thomas H. Fraser, and Ernest A. Lachner

Abstract.—Two large species of Indo-Pacific cardinalfishes of the genus *Apogon,* subgenus *Ostorhinchus,* previously identified either as *A. aureus* (Lacepède) or *A. fleurieu* (Lacepède), are shown to be distinct. Their most characteristic color marking is a black bar encircling the caudal peduncle. They are separated by gillraker counts (22–27 for *aureus,* 19–23 for *fleurieu*) and the form of the black peduncular marking (a spot on juvenile *fleurieu,* expanding to a bar in adults; always a bar in *aureus,* typically broader dorsally and ventrally to a slight hourglass shape. Both species occur from East Africa (only *fleurieu* in the Red Sea) to the western Pacific; *fleurieu* is known only from continental shelf localities except for the Seychelles. A third species with a black peduncular bar, *A. pselion,* is described as new from specimens from the northern Red Sea. It is more slender (depth 2.8–3.4 in SL), small (largest 41.3 mm SL), and distinctive in life color (four dusky yellow stripes on head separated by blue lines, one stripe continuing as a yellow band midlaterally on body).

The Apogonidae (popularly known as cardinalfishes) is one of the largest families of tropical fishes; the great majority of these fishes are found in the marine environment. Apogonids are small (only a few species exceed 20 cm total length), with two separate dorsal fins (the first of VI to VIII spines), II anal spines, a double-edged preopercle, large eyes, and a large oblique mouth. Most are nocturnal, and those for which the reproductive strategy is known are mouth brooders.

Fraser (1972) recognized three subfamilies and 20 genera in the family. Nelson (1984) wrote that there are about 192 species, but it is clear from the number of undescribed species on museum shelves and probably more that remain to be discovered in the sea that well over 200 species will eventually be recorded.

There has long been confusion over the correct specific name for a large species of *Apogon* with a broad black bar posteriorly on the body which occurs in the Indian Ocean and western Pacific. Most authors have used the name *Apogon aureus* (Lacepède) for this fish, but some (Gon 1987, gave 12 references[1]) have called it *A. fleurieu* (Lacepède). Lacepède (1802:23) described the latter as *Ostorhinchus fleurieu*; his illustration from a drawing by Commerson was published as fig. 2 of pl. 32 in volume 3 of Histoire Naturelle des Poissons (1801) (reproduced by Gon 1987: fig. 2). Lacepède's description, obviously based on Commerson's drawing and not a specimen, appeared in volume 4 (1802:23). Because no teeth are apparent on the drawing, Lacepède assumed that they were fused to form dental plates like those of scarids, diodontids, and tetraodontids. This led Whitley (1959) to

[1] Weber & de Beaufort (1929:319) used *Apogon aureus,* not *A. fleurieu.*

regard *fleurieu* as an oplegnathid. Smith (1961) realized that Lacepède's figure is an apogonid. He wrote, "Most workers have refused to accept Lacepede's *fleurieu* on the grounds that it is not an Apogonid fish. To me his 1802, Pl 32, fig. 2 of *fleurieu* represents nothing else, . . ."

Fraser (1972) discussed the controversy in detail. He opted for the use of *Apogon aureus* (which was described by Lacepède, 1802:253, 273, 275, as *Centropomus aureus*) because the description of *Ostorhinchus fleurieu* "does not agree with any apogonid". He was influenced in his decision by Lacepède's description of the dentition, the apparent lack of a lateral line, and the high number of rays of the second dorsal fin (14). He concluded, "Perhaps the best course of action would be the rejection of the name on the basis that it is an unidentifiable taxon."

The second author suspected as early as 1974 that two species had been confused under the presumed synonymous names *Apogon aureus* and *A. fleurieu.* About five years ago both junior authors had determined that there were indeed two species and differentiated them by gillraker count and the form of the dark peduncular bar. In one species both juveniles and adults have a well-defined dark peduncular bar that is usually expanded dorsally and ventrally to form a slight hourglass shape. Juveniles of the other species have a dark spot centroposteriorly on the peduncle which expands with growth to form a solid bar, but without dorsal and ventral expansions. At that time the junior authors were inclined to preserve the name *Apogon fleurieu* for one species and describe the other as new. They were subsequently joined by the senior author, and with the analysis of more specimens and the original Lacepède accounts of the two species, it was concluded that both the names *fleurieu* and *aureus* should be recognized. In the meantime Gon (1987) reviewed the problem of Lacepède's apogonid names *fleurieu* and *aureus.* Like Smith (1961), he regarded Lacepède's illustration of *fleurieu* as identifiable and placed *aureus* in its synonymy. He designated a neotype for *fleurieu* (BPBM 15821, 94 mm SL, from Papua New Guinea) and illustrated it.

Lacepède's figure of *fleurieu* exhibits a peduncular bar that is narrower dorsally and ventrally, thus typical of a specimen that had a peduncular spot as a juvenile but had not yet developed a complete bar. It is clear from Gon's (1987) description of *fleurieu* and his material that he had both species. Unfortunately he chose a specimen with the hourglass peduncular bar as the neotype of *fleurieu.* If we were to follow Gon in his neotype designation, we would need to describe the other species as new. We prefer to link *fleurieu* to the species with the peduncular bar like Lacepède's figure bearing this name, thus leaving the species with the hourglass bar as *aureus.* It may be argued that Lacepède's description of *Centropomus aureus* is not diagnostic for either of these species. However, the type localities of Mauritius and Réunion strongly suggest that the one with the hourglass bar was the species described by Lacepède. We have examined specimens of this species from six collections from Mauritius. Unfortunately, all are in poor condition and none merits neotype designation. The other species, *A. fleurieu,* is known thus far only from continental shelf localities except for three lots from the Seychelles which are stranded continental fragments (for discussion see Springer 1988:128–129).

In retaining the name *Apogon aureus* for the species which is the best represented of the two in museum collections and most often reported in the literature by this name, we are being less disruptive to nomenclatural stability than if we were to adopt the name *fleurieu* for this fish.

Because of the great similarity of *Apogon aureus* and *A. fleurieu* we have included literature records of these two species and plotted the distributions of Fig. 1 only from specimens reported in sufficient detail to

permit identification (generally this meant a good illustration) or from the examination of specimens.

As pointed out by both Fraser (1972) and Gon (1987), the recognition of *Apogon fleurieu* as a valid taxon will result in *Ostorhinchus* Lacepède (type series, *O. fleurieu* Lacepède) replacing *Nectamia* Jordan as a subgenus of the genus *Apogon.* See Fraser (1972) for a diagnosis of *Ostorhinchus* (as *Nectamia*).

Bleeker (1874) recorded *Dipterodon hexacanthus* Lacepède (1801:pl. 30, fig. 2; 1802: 166, 168) as a junior synonym of *Amia* (=*Apogon*) *aurea* Lacepède. He was followed by Day (1875) and Weber & de Beaufort (1929) (though questioned). Barnard (1927) stated that this nominal species cannot be included in the synonymy of *aureus* because the description of the dentition is not that of an *Apogon.* Fowler & Bean (1930), however, did not agree with Barnard, pointing out that both *Ostorhinchus fleurieu* and *Dipterodon hexacanthus* have a dark transverse band across the caudal peduncle. They added, "The large teeth shown in the figure of the latter we think an error in engraving." Fraser (1972) admitted that *D. hexacanthus* could be an apogonid, but at best a *Cheilodipterus,* not an *Apogon.* He wrote, "I treat this name as a *nomen dubium,* perhaps involving a member of the Apogonidae." Gon (1987) accepted Fraser's opinion, and we also concur.

Specimens of a third species of *Apogon* with a dark peduncular bar that were collected by the senior author and colleagues in the northern Red Sea represent an undescribed species. Though notably smaller than either *aureus* or *fleurieu,* this species could easily be misidentified as the young of the former. The purpose of the present paper is to provide descriptions of all three species and to differentiate them.

Apogonid material for the present study has been examined at or obtained from the following institutions: Australian Museum, Sydney (AMS); Academy of Natural Sciences of Philadelphia (ANSP); British Museum (Natural History), London (BMNH); Bernice P. Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS, SU); Hebrew University, Jerusalem (HUJ); Museum National d'Histoire Naturelle, Paris (MNHN); National Science Museum, Tokyo (NSMT); Queensland Museum, Brisbane (QM); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); J. L. B. Smith Institute of Ichthyology, Grahamstown (RUSI); Tel Aviv University, Ramat Aviv (TAU); U.S. National Museum of Natural History, Washington, D.C. (USNM); and Western Australian Museum, Perth (WAM).

Lengths given for specimens are standard length (SL), measured from the front of the upper lip to the base of the caudal fin (posterior end of hypural plate); body depth is the depth from the base of the anterior dorsal spines; body width is measured just posterior to the gill opening; head length is measured from the front of the upper lip to the end of the opercular membrane, and snout length from the same anterior point to the fleshy edge of the orbit; orbit diameter is the greatest fleshy diameter and interorbital width the least bony width; caudal peduncle depth is the least depth, and caudal peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; lengths of fin spines and soft rays are measured to their extreme base; caudal concavity is the horizontal distance between verticals at the tips of the shortest and longest caudal rays.

Pectoral-ray counts include the rudimentary upper ray; lateral-line scale counts are made to the base of the caudal fin (hence do not include the pored scales posterior to the hypural plate); gillraker counts are made on the first gill arch and include all rudiments; the count of the upper-limb rakers is given first; the raker at the angle is contained in the lower-limb count.

Counts of the rays of the median fins are the same for all three species. Pectoral-ray

Table 1.—Gillraker counts of species of *Apogon*.

	Upper limb				Lower limb						Total gillrakers							
	5	6	7	8	14	15	16	17	18	19	20	19	20	21	22	23	24	25	26	27
aureus (total)		73	93	8			10	84	39	34	4				6	59	40	29	30	7
Comoros			35	4					5	31	3							5	28	6
Other localities		73	58	4			10	84	34	3	1				6	59	40	24	2	1
fleurieu (total)	30	129	4		1	49	90	23				1	16	46	74	26				
Red Sea	9	43	1			13	38	2					3	16	31	3				
Seychells	2	34	3				24	15						2	19	18				
Other localities	19	52			1	36	28	6				1	13	28	24	5				
pselion	15	25			4	15	20					4	7	19	11					

counts are nearly always 14. Gillraker counts, however, are useful in distinguishing the new species and *Apogon fleurieu* from *A. aureus* (Table 1).

Tables 2–4 present proportional measurements of specimens of the three species as percentages of the standard length. Body and fin proportions are given in the text to the nearest 0.05.

Paratypes of the new species are listed chronologically by date of collection. Data in parentheses in the description of the new species refer to paratypes.

Apogon aureus (Lacepède)
Figs. 1–4; Tables 1, 2

Centropomus aureus Lacepède, 1802:253, 273, 275 (type localities, Mauritius and Réunion).

Apogon roseipinnis Cuvier in Cuvier & Valenciennes 1829:490 (type locality, Sri Lanka).—Valenciennes in Cuvier & Valenciennes 1830:553 (Ambon).

Apogon annularis var. *roseipinnis* (non Cuvier) Günther, 1859:239 (in part) (Hong Kong).

Apogon annularis (non Rüppell) Playfair & Günther, 1867:20 (Zanzibar).—Boulenger, 1887:655 (Muscat, Oman).

Amia aurea Bleeker, 1874:48 (Indonesian localities).—Bleeker, 1873–1876:92, pl. 337, fig. 1.

Apogon aureus Macleay, 1883:236 (Port Moresby, New Guinea).—Sauvage, 1891: 142 (Sulawesi, Sri Lanka, Mauritius, and Madagascar).—Weber & de Beaufort, 1929:319 (Indonesian localities, northern New Guinea).—Munro, 1955:120, pl. 21, fig. 329 (Sri Lanka).—Woodland & Slack-Smith, 1963:31 (Heron Island, Great Barrier Reef).—Ida & Moyer, 1974:114, fig. 5B (Miyake-jima, Japan).—Masuda et al., 1975:204, pl. 37G (southern Japan).—Burgess & Axelrod, 1975:1447, fig. 10 (Vanuatu).—Fourmanoir & Laboute, 1976: 288 (figure with erroneous color) (New Caledonia).—Burgess & Axelrod, 1976:

Table 2.—Proportional measurements of specimens of *Apogon aureus* expressed as a percentage of the standard length.

	BPBM 23388	SU 27353	SU 27353	BPBM 19410	CAS 62567	BPBM 30648	BPBM 30648	BPBM 15921	SU 27367	BPBM 20151
Standard length (mm)	33.1	49.9	56.2	70.5	76.8	87.2	91.0	94.0	99.6	108.5
Body depth	35.2	38.8	40.0	39.4	40.3	41.4	40.2	42.5	44.0	41.4
Body width	15.7	16.0	16.4	15.9	16.3	15.0	15.3	15.9	17.2	14.8
Head length	40.3	39.6	38.6	41.1	39.9	41.7	40.4	40.3	38.7	39.3
Snout length	8.8	8.9	8.9	9.3	9.3	8.9	9.5	9.1	8.7	9.8
Orbit diameter	15.8	14.2	14.0	13.8	14.3	14.4	14.4	14.5	12.6	13.5
Interorbital width	9.6	9.7	8.9	9.6	9.9	9.7	9.9	9.8	9.1	9.3
Upper jaw length	20.9	20.2	19.6	20.1	20.4	20.4	21.0	21.1	19.8	20.3
Caudal peduncle depth	14.2	16.8	17.5	17.7	17.2	16.6	17.4	17.0	17.4	17.6
Caudal peduncle length	24.1	23.6	23.7	22.8	24.5	23.5	22.0	23.0	23.4	21.9
Predorsal length	42.3	40.7	41.0	43.3	42.2	43.2	41.7	43.5	41.7	41.8
Preanal length	63.3	62.8	63.0	63.7	64.5	65.4	65.7	65.9	65.1	64.1
Prepelvic length	39.3	40.2	38.0	40.6	40.2	40.4	41.5	41.7	40.0	39.7
Length of first dorsal spine	3.5	3.2	4.3	3.1	3.9	4.3	4.0	4.1	3.2	3.9
Length of second dorsal spine	9.6	9.8	10.6	10.1	10.8	11.4	10.2	11.2	9.0	10.6
Length of third dorsal spine	17.6	20.6	broken	21.4	20.8	22.4	23.1	21.6	21.1	23.5
Length of fourth dorsal spine	17.5	20.2	broken	21.4	20.6	22.1	22.4	20.7	broken	22.2
Length of spine of second dorsal fin	14.8	16.6	16.0	16.9	16.3	16.1	17.0	17.9	15.5	15.4
Length of longest dorsal ray	25.4	broken	26.0	28.1	24.9	27.5	27.8	27.6	25.2	26.7
Length of first anal spine	4.1	4.2	3.8	4.4	4.6	3.6	4.4	5.1	3.6	4.7
Length of second anal spine	14.7	16.0	15.7	14.5	15.9	16.0	16.2	17.2	14.7	15.5
Length of longest anal ray	23.5	25.3	24.4	24.9	26.0	24.1	23.6	24.2	23.0	broken
Caudal fin length	35.0	broken	broken	35.2	36.2	35.5	35.7	broken	33.5	32.4
Caudal concavity	12.4	—	—	12.9	12.0	13.1	12.9	—	10.2	10.1
Pectoral fin length	26.9	26.5	25.2	27.1	27.2	28.1	28.7	28.9	26.4	27.2
Pelvic spine length	14.9	16.0	16.3	16.7	15.9	15.5	16.6	17.2	15.1	16.6
Pelvic fin length	21.7	23.0	24.0	26.4	24.6	24.4	25.8	26.3	23.9	25.5

Table 3.—Proportional measurements of specimens of *Apogon fleurieu* expressed as a percentage of the standard length.

	BPBM 18258	USNM 191704	HUJ 11922	BPBM 27638	BPBM 27638	USNM 212416	USNM 212416	USNM 212416	BPBM 19811	BPBM 31874
Standard length (mm)	32.9	42.0	52.9	60.3	65.2	70.6	77.7	82.2	96.2	102.1
Body depth	35.2	36.2	36.7	38.4	39.9	38.0	40.6	40.9	41.5	41.7
Body width	16.4	16.2	16.4	16.9	17.4	17.3	17.3	17.8	16.6	16.7
Head length	42.5	40.2	39.7	41.4	40.5	40.9	39.8	41.4	39.6	39.6
Snout length	9.1	9.4	9.5	9.3	9.6	9.5	9.3	9.7	9.4	9.5
Orbit diameter	16.7	14.6	13.6	13.3	13.6	13.5	13.2	13.6	13.1	12.9
Interorbital width	9.9	9.6	9.8	9.5	9.6	8.9	9.3	9.1	8.8	8.9
Upper jaw length	21.6	20.0	19.8	19.9	20.7	20.2	20.3	21.3	20.7	19.9
Caudal peduncle depth	15.8	16.6	16.1	17.1	16.8	16.2	16.7	16.1	16.8	16.7
Caudal peduncle length	23.7	23.3	22.2	21.6	22.1	23.0	21.9	20.8	22.0	21.0
Predorsal length	42.7	41.2	43.0	42.8	42.0	41.5	41.3	43.2	43.2	42.0
Preanal length	65.4	62.0	61.1	63.4	65.1	63.4	65.8	66.1	64.4	65.5
Prepelvic length	39.8	37.0	38.5	39.2	39.9	40.4	40.0	41.4	39.8	39.8
Length of first dorsal spine	3.6	3.9	3.2	3.3	3.8	4.1	4.1	3.1	3.1	3.3
Length of second dorsal spine	10.8	11.6	broken	11.4	10.3	10.4	10.9	10.0	9.4	9.0
Length of third dorsal spine	20.3	19.0	19.3	21.9	20.2	20.0	21.0	20.6	20.7	19.2
Length of fourth dorsal spine	19.2	18.6	19.5	21.6	19.9	broken	21.0	21.5	21.7	20.9
Length of spine of second dorsal fin	16.7	17.2	16.2	16.3	15.7	15.9	16.7	16.4	16.1	15.8
Length of longest dorsal ray	27.3	27.4	26.5	27.2	27.1	25.8	27.3	28.1	25.4	26.5
Length of first anal spine	4.1	4.8	broken	4.8	4.7	4.3	4.9	4.8	4.7	4.0
Length of second anal spine	15.8	16.2	14.6	15.7	15.8	14.8	15.6	15.6	16.2	14.7
Length of longest anal ray	24.2	broken	23.7	24.8	23.3	23.4	24.6	23.7	22.8	broken
Caudal fin length	33.4	broken	33.8	33.5	33.3	32.2	32.2	33.6	32.2	broken
Caudal concavity	11.4	—	9.8	11.9	9.7	10.9	11.6	10.0	10.3	—
Pectoral fin length	26.6	26.1	26.1	27.4	26.3	26.2	27.7	27.8	26.3	25.6
Pelvic spine length	17.2	16.4	15.5	16.7	16.3	15.7	16.0	15.6	15.5	14.8
Pelvic fin length	24.0	23.6	23.6	26.2	25.8	24.8	24.4	25.3	23.7	23.6

Table 4.—Proportional measurements of type specimens of *Apogon pselion* expressed as a percentage of standard length.

	Holotype	Paratypes							
	BPBM 21515	USNM 213387	BPBM 18261	TAU 9670	BPBM 18261	BPBM 31988	BPBM 31988	BPBM 31988	USNM 213383	USNM 213383
Standard length (mm)	36.2	20.6	23.2	26.5	33.5	33.8	36.6	39.2	39.6	41.3
Body depth	34.0	29.6	31.2	30.0	35.3	33.2	33.4	35.5	34.9	33.1
Body width	14.4	15.5	14.2	12.2	14.0	14.7	15.2	15.6	16.6	15.0
Head length	39.2	38.8	39.0	39.4	39.3	39.2	39.1	38.4	40.7	38.8
Snout length	10.2	9.7	9.9	9.5	9.3	9.2	9.1	9.2	9.4	9.7
Orbit diameter	14.0	15.5	15.1	15.2	15.1	14.5	13.9	13.7	13.5	13.1
Interorbital width	8.0	8.5	8.4	7.5	8.3	8.1	8.2	8.0	7.5	7.7
Upper jaw length	19.9	19.9	20.2	19.3	20.9	19.8	20.5	19.2	20.7	19.5
Caudal peduncle depth	15.2	11.7	13.3	12.2	14.7	14.2	15.8	15.5	12.3	14.3
Caudal peduncle length	24.4	24.8	25.8	24.1	25.6	24.7	25.0	24.0	25.3	25.5
Predorsal length	40.2	42.4	41.0	41.4	42.2	41.8	40.5	41.9	41.7	40.7
Preanal length	62.2	60.8	61.0	60.0	62.6	60.3	60.7	62.5	62.7	61.5
Prepelvic length	38.2	37.9	38.4	37.8	39.1	37.8	38.2	38.2	40.1	37.5
Length of first dorsal spine	3.3	3.2	3.9	3.4	3.3	3.6	4.0	3.8	2.8	3.6
Length of second dorsal spine	11.0	12.4	12.7	11.7	11.6	11.5	10.4	11.5	10.5	10.2
Length of third dorsal spine	18.9	18.4	19.8	20.7	18.5	20.0	18.1	18.4	18.9	18.7
Length of spine of second dorsal fin	15.0	broken	16.2	14.7	15.5	14.8	14.2	15.3	14.4	14.7
Length of longest dorsal ray	24.6	broken	26.0	broken	24.7	23.7	23.9	25.5	broken	broken
Length of first anal spine	4.7	4.8	5.3	5.4	4.3	5.3	4.9	5.0	3.8	4.0
Length of second anal spine	13.1	15.0	15.9	14.4	13.8	13.3	14.2	13.1	14.3	broken
Length of longest anal ray	20.4	broken	22.8	broken	20.7	20.7	19.9	21.7	broken	broken
Caudal fin length	31.0	broken	30.5	broken	31.3	32.3	29.0	27.8	broken	broken
Caudal concavity	8.4	—	8.8	—	9.0	8.0	9.1	9.4	—	—
Pectoral fin length	24.9	24.5	24.6	broken	25.2	24.8	22.5	25.3	24.5	23.3
Pelvic spine length	14.1	15.1	15.9	15.1	14.9	14.2	14.2	15.0	13.9	14.4
Pelvic fin length	22.1	20.9	23.3	22.6	22.2	22.5	21.9	23.0	22.8	22.5

1678, fig. 25 (Great Barrier Reef).—Allen & Steene, 1979:28 (Christmas Island, Indian Ocean).—Schroeder, 1980:145, fig. (western Sulu Sea, Philippines).—Russell, 1983:47 (southern Great Barrier Reef).—Hayashi & Kishimoto, 1983:27, pl. 5, fig. 21 (Iriomote Island, Ryukyus and Osezaki, Shizuoka Prefecture).—Shen, 1984: 48, figs. 304–6a, 6c (Taiwan).—Masuda et al., 1984:147, pl. 131 I (southern Japan).—Gloerfelt-Tarp & Kailola, 1984: 145, 327, fig. on 144 (off Bali).—Gon in Smith & Heemstra, 1986:549, pl. 48, fig. 175.3 (East Africa south to Durban).—Shao & Chen, 1986:93, fig. 38 (Taiwan).—Allen & Steene, 1987, pl. 35, fig. 2 (Christmas Island, Indian Ocean).—Al-Baharna, 1986:71, fig. (Bahrain).

Amia fleurieu (non Lacepède) Fowler, 1918: 65 (Philippines).—Fowler, 1927:274 (Philippines).—Fowler & Bean, 1930 (Philippine and Indonesian localities and Borneo).

Apogon fleurieu (non Lacepède) Smith, 1949:207, pl. 22, fig. 481 (Natal and Mozambique).—Fourmanoir, 1957:83, fig. 59 (Comoro Islands).—Shen & Lam, 1977:177, fig. 21 (Taiwan) (misspelled *fleurien*).—Gon, 1987:140, fig. 1 (in part).

Ostorhynchus fleurieu (non Lacepède) Smith, 1961:399, pl. 46D (in part).—Smith & Smith, 1963:20, pl. 60D (Seychelles).

Gronovichthys aureus Munro, 1967:244, 251, pl. 29, fig. 432 (New Guinea).

Diagnosis.—A species of the genus *Apogon,* subgenus *Ostorhinchus,* with dorsal rays VII–I,9; pectoral rays 14 (rarely 13 or 15); lateral-line scales 24; median predorsal scales 5; total gillrakers 22–27; preopercular ridge smooth, the posterior margin and most of ventral margin serrate; body depth 2.25–2.85 in SL; interorbital width 4.05–4.35 in head; posterior nostril usually only slightly larger than anterior; pale (coppery with iridescence in life) with a black bar encircling posterior caudal peduncle in both young and adult, its midlateral width one-half to two-thirds orbital diameter, its upper and lower edges expanded to form a slight hourglass shape, a broad blackish stripe from front of snout to orbit, continuing behind eye, this stripe bordered by a blue line in life; a narrow blackish streak (blue in life) on maxilla and continuing a short distance posterior; a small blackish spot on each lateral-line scale; a row of dark dashes basally in anal fin; maximum standard length about 125 mm.

Description.—Dorsal rays VII–I,9, all rays branched, the last to base; anal rays II,8, all rays branched, the last to base; pectoral rays 13(2), 14(64), 15(4), the upper two and lower one or two unbranched; pelvic rays I,5; principal caudal rays 17, the upper and lower unbranched; upper and lower procurrent caudal rays 8 or 9, the posterior two segmented; lateral-line scales 24 (plus 4 pored scales posterior to caudal-fin base, the last long and pointed); scales above lateral line to origin of dorsal fin 2; scales below lateral line to origin of anal fin 6; median predorsal scales 5, the fourth and fifth deeply indented posteriorly in the midline; circumpeduncular scales 12 (minimum zigzag count); gillrakers 6–8+16–20, 1–2 upper and 0–1 lower as rudiments, the total count 22–25; pseudobranchial filaments 16 in a 33 mm specimen, 27 in a 92 mm one, and 32 in a 108.5 mm one; branchiostegal rays 7; predorsal bones 3; vertebrae 10+14.

Body moderately deep, the depth 2.25–2.85 in SL, and compressed, the width 2.1–2.8 in depth; head length 2.4–2.6 in SL; dorsal profile of head slightly convex to straight except for rounded front of snout; snout length 4.0–4.65 in head; eye large; the orbit diameter 2.55–3.05 in head; interorbital space flat to slightly convex with median and lateral longitudinal ridges, the least width 4.05–4.35 in head; caudal peduncle depth 2.2–2.85 in head; caudal peduncle length 1.65–1.85 in head.

Mouth large, the maxilla reaching to or slightly posterior to a vertical at rear edge of pupil, the upper jaw length 1.9–2.1 in head; mouth oblique, forming an angle of

about 35° to horizontal axis of head and body; posterior margin of maxilla slightly rounded to slightly concave, the corners rounded; supramaxilla not present; lower jaw projecting, knob-like; upper jaw with a broad band of villiform teeth except for gap at symphysis, the teeth of the outer rows slightly incurved and inwardly depressible, the teeth of the inner rows at side of jaw very small; a narrow band of villiform teeth in lower jaw, with three or four rows at front of jaw and a single row posteriorly, the inner teeth longer than outer; vomer with one to two rows of small teeth forming a V-shape with rounded apex; palatines with a single irregular row of small teeth. Tongue broadly triangular, the tip moderately pointed.

Anterior nostril a short membranous tube located in front of center of orbit nearly half distance to anterior end of snout; posterior nostril ovate to slit-like, without a rim, located obliquely dorsoposterior to anterior nostril, the internarial distance about 1.5 times greater than distance from posterior nostril to orbit; posterior nostril usually only slightly larger than anterior; large openings, one in front of anterior nostril, one below internarial space and one at edge of interorbital space, leading to broad subsurface channels; a pair of prominent pores on tip of lower jaw; numerous small sensory pores over dorsal surface of head, side of snout, suborbital region, naked part of preopercle, and mandible.

A single, poorly developed, flat, obtuse spine on opercle at level of upper edge of pupil; preopercular ridge smooth; posterior margin, rounded corner, and most of ventral margin of preopercle serrate (35 serrae on 33 mm specimen, 73 on 92 mm fish).

Lateral line conspicuous, very slightly arched anteriorly, then paralleling dorsal contour of body and ending midlaterally a short distance onto base of caudal fin; scales ctenoid; head naked except for cheek, opercle, subopercle, and nape; no scales on dorsal and anal fins except for a very low sheath of small scales on extreme base of second dorsal and anal fins; basal part of caudal fin with progressively smaller scales that extend about half distance to posterior margin; paired fins naked except for triangular scaly process basally on lower surface of pelvic fins.

Origin of first dorsal fin above base of third lateral-line scale; first dorsal spine slender and short, about one-third length of second spine; second dorsal spine 3.6–4.3 in head; third dorsal spine longest (though only slightly longer than fourth), 1.65–2.3 in head; first dorsal soft ray longest, 1.45–1.6 in head; origin of anal fin below base of third dorsal soft ray; anal spine small, 3.4–4.45 in length of second spine; second anal spine 2.35–2.85 in head; first anal soft ray longest, 1.55–1.75 in head; caudal fin forked, the caudal concavity 3.15–3.9 in head, the fin length 2.75–3.1 in SL; third or fourth pectoral rays longest, 1.4–1.5 in head; origin of pelvic fins slightly anterior to upper base of pectorals; pelvic fin tips extending well beyond anus, often to origin of anal fin, the first soft ray longest, 1.5–1.85 in head.

Color in alcohol pale to light brown with a dark brown bar encircling posterior caudal peduncle, its midlateral width about one-half to two-thirds orbit diameter, its upper and lower edges usually expanded to produce a slight hourglass shape; a dark brown stripe from front of snout, broadening as it passes to orbit, and continuing diffusely a short distance posterior to eye, its edges often darker brown; tip of snout dark brown; a narrow brown streak on maxilla and continuing a short distance beyond it; lower opercle, subopercle, thorax, and lower abdomen of some specimens partly silvery; tubular anterior nostril pale; a small dark brown spot on underside of each lateral-line scale, usually visible externally (more evident on anterior than posterior scales); fins pale except anterior part of first dorsal fin, proximal upper and lower edges of caudal fin and lateral edge of pelvic fins which are dusky, and a dark brown line basally in anal fin, interrupted by each ray, which diverges

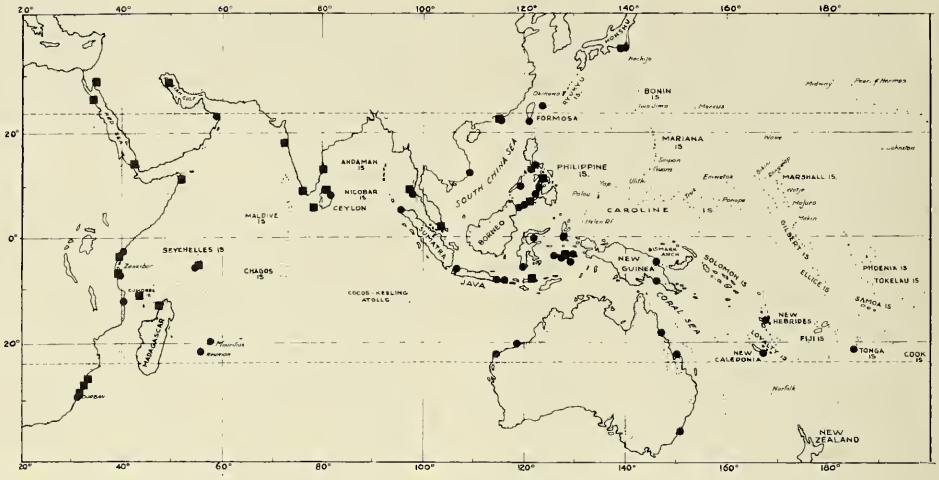

Fig. 1. Distributions of *Apogon aureus* (●) and *A. fleurieu* (■).

outward from midbase of fin to end in a streak on last ray; peritoneum pale; digestive tract black; gillrakers dusky.

Color in life coppery with iridescence, paler posteriorly, becoming golden on postorbital head and side of body; a black bar across posterior caudal peduncle, broader dorsally and ventrally; a blackish stripe, edged in bright blue, from front of snout through eye, continuing diffusely a short distance behind eye where the blue margins tend to break up into dashes and spots; some individuals with a few indistinct bluish spots anteriorly on side of body; tip of lower jaw blackish; a bright blue line on upper lip, extending across maxilla, and continuing a short distance posterior to maxilla; lateral line pale with a series of small blackish spots, one per scale (spots progressively fainter, and often absent, posteriorly); median fins with pale orange-yellow membranes and salmon pink rays, the anterior part of the first dorsal fin dusky orange; distal part of lobes of second dorsal, anal, and caudal fins sometimes red; base of anal fin with a narrow orange band separated from an adjacent outer narrow blue band by a black line on membranes of fin; pectoral fins pale yellowish with light orange rays; pelvic fins with yellow membranes and orange rays, the lateral edge dusky bluish.

Remarks.—As mentioned above, *Apogon aureus* is very similar to *A. fleurieu*; previously these two taxa were considered synonymous. See the Remarks of the following account (of *fleurieu*) for discussion of their similarities and differences.

Apogon aureus occurs from the coast of East Africa to the western Pacific where it ranges from southern Japan to Sydney, New South Wales; it is known from the following islands: Madagascar, Réunion, Mauritius, Seychelles, Sri Lanka, Christmas, Indonesia, Philippines, Taiwan, New Guinea, Vanuatu, and New Caledonia. With the exception of the Tonga Islands where the senior author has observed and photographed the species underwater, it is not known from the islands of Micronesia and Polynesia. In spite of much collecting, it has not been taken at the atolls of the Maldives or Chagos Archipelago. It has not been observed or collected in the Red Sea or Persian Gulf and is as yet unknown from the coasts of India, Burma, and Thailand. It has, however, been recorded from the Gulf of Oman (as *Apogon annularis*) by Boulenger (1887); Boulenger's specimen from Muscat was examined at the British Museum (Natural History).

Collections of this species have been made in the depth range of 1–30 m from coral reefs or rocky substrata where there are caves

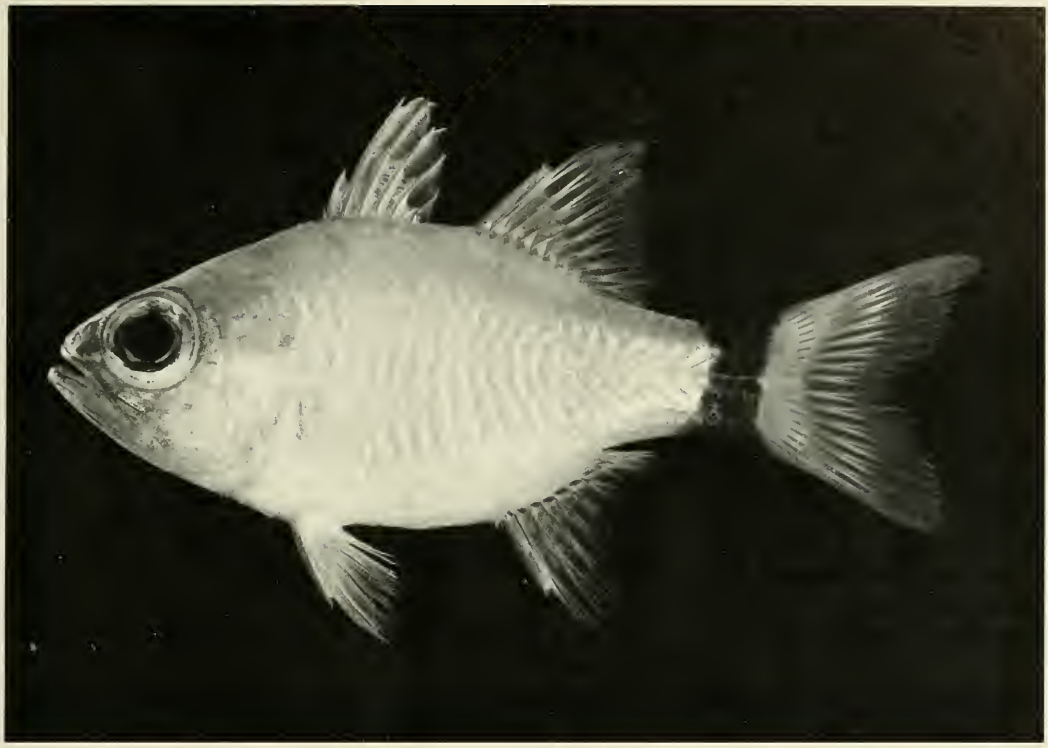

Fig. 2. Adult of *Apogon aureus,* BPBM 30648, 92 mm SL, Port Moresby, Papua New Guinea.

or crevices to provide shelter by day. The senior author photographed the species off northeastern Bali in 40 m. It does not normally occur in areas subject to much wave action. The localities where collections have been made in only a few meters of water are all in well-protected bays or lagoons.

Apogon aureus is generally encountered in small aggregations, sometimes mixed with *A. apogonides* (Bleeker). As noted by Ida & Moyer (1974), it is unusually bold for an apogonid and will venture a short distance from shelter to approach a diver if he remains still. It leaves the shelter of the reef shortly before sunset for nocturnal feeding, mainly on the larger zooplankton.

In 1975 John E. McCosker and associates collected 39 specimens (CAS 35490) of a cardinalfish identified as *Apogon aureus* at Grande Comore, Comoro Islands, in caves in 20–30 m. These fish are immature and range in SL from 37–55 mm. We took routine meristic data on all 39 specimens. The lower-limb gillraker count is high, 18–20 (see Table 1, under *aureus*). Since no other differences could be found between the Comoro fish and typical *aureus,* we provisionally identify them as *A. aureus.* It is hoped that future collecting at these islands will result in specimens of the adult of this form and a record of its life color.

Material examined.—East Africa: RUSI 3205, 54 mm. Kenya: Mombasa, BMNH 1913.4.7.51, 92 mm. Zanzibar: BMNH 1867.3.7.555, 84 mm; RUSI 3167, 86 mm. Mozambique: Bazaruto Island, RUSI 3168, 80 mm. Pinda, RUSI 3164, 86.5 mm. Mozambique Island, RUSI 3165, 3: 64.5–87 mm. Natal: Durban, BMNH 1916.9.23.14, 81 mm; RUSI 11655, 8: 86–92 mm; SU 31278, 68 mm. Madagascar: MNHN 8762, 73 mm; USNM 17104, 3: 78–83 mm. Nossi Bé, USNM 212408, 2: 62–79 mm. Mauritius: BMNH 1934.2.22.11, 98 mm; BMNH

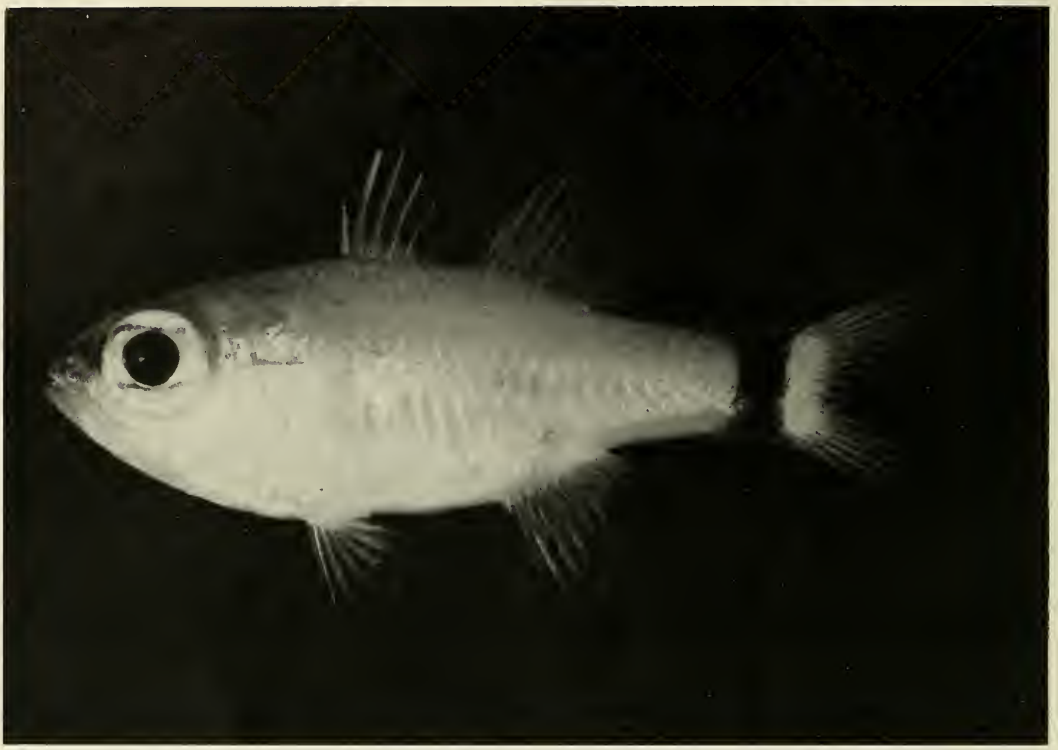

Fig. 3. Juvenile of *Apogon aureus,* BPBM 23388, 32 mm SL, Taiwan.

1937.5.26.9, 98 mm; BMNH 1941.4.18.17, 97 mm; BPBM 20151, 5: 105–118 mm; MNHN 8759, 3: 66–81 mm; RUSI 1158, 3: 99–108 mm. Seychelles: Mahé, RUSI 3166, 71 mm. Gulf of Oman: Muscat, BMNH 1887.11.11.65, 99 mm; BMNH 1901.1.30.48, 64 mm. Sri Lanka: Trincomalee, USNM 212422-24, 10: 61–88 mm; USNM 212587, 86.5 mm; MNHN 8700, 74.5 mm, holotype of *Apogon roseipinnis.* Sumatera (Sumatra): Weh, RMNH 12730, 4: 43–84 mm. Viet Nam: Nha Trang Bay, CAS 62567, 52: 74–95 mm; CAS 62568, 7: 90.5–98 mm. Jawa (Java): Jakarta, RMNH 12731, 86.5 mm. Java Sea, RMNH 12733, 77 mm. Sulawesi (Celebes): MNHN 60, 56.5 mm. Gulf of Tomini, Dodepo and Pasejogo Islands, USNM 171278, 2: 64–71 mm. Simba Strait, USNM 171290, 48.5 mm. Makassar Island, USNM 171294, 8: 24–51 mm. Buton Strait, Labuan Blanda Island, USNM 171292, 3: 35–46 mm. Selayar, RMNH 10020, 84 mm. Bali, BPBM 32247, 3: 45–48 mm. Lombok, BPBM 30047, 87 mm. Molucca Islands: Ambon, BPBM 19410, 5: 70.5–86 mm; MNHN 8699, 2: 79–80 mm; MNHN 8706, 73 mm; RMNH 8158, 5: 70–89 mm; USNM 210441, 26 mm. Buru (Bouro), USNM 171281, 4: 55–78 mm; Tomahu Island (near Buru), USNM 171283, 62–77 mm; USNM 212425, 72 mm. Seram (Ceram), BMNH 1858.4.21.175,180, 2: 70–81 mm. Bacan (Batjan), RMNH 13056, 76 mm. Gillolo Island, USNM 171280, 78 mm. Makyan Island, USNM 171291, 73 mm; USNM 171276, 7: 75–87 mm. Saparua Island, USNM 210076, 4: 75–81 mm; USNM 210357, 44: 22–81 mm. Tidore Island (south of Ternate), USNM 171282, 3: 80–83 mm; Dowarra Island, USNM 171290, 47 mm. Banda Islands: Banda Neira, USNM

Fig. 4. Underwater photograph of *Apogon aureus,* about 95 mm TL, Bali.

213077, 49 mm. Western Australia: Ashmore Reef, AMS I.26742-024, 2: 32–33 mm. Northwest Cape, AMS I.19641-004, 2: 97–97.5 mm. Dampier Archipelago, Rosemary Island, AMS I.19688-006, 2: 41–44.5 mm. Warroora, QM I.10263, 103 mm. Borneo: Sabah, Darvel Bay, Danawan and St. Amil Islands, USNM 171268, 2: 72.5–73 mm. Philippines: Sulu Archipelago, Singaan Island, USNM 171279, 3: 57–73 mm. Simaluc Island and Simaluc Sibi Sibi Island, USNM 171275, 7: 41–80 mm. Jolo, SU 27367, 6: 92.5–107 mm. Tumindao Island, USNM 171277, 85 mm. Mindanao: Basilan Island, USNM 171288, 86 mm. Tonquil Island, USNM 171269, 2: 77–80 mm. Malanipa Island, USNM 171273, 2: 64–81 mm. Tulnalutan Island, USNM 171270, 64 mm. Inamucan Bay, USNM 171274, 90 mm. Murcielagos Bay, USNM 171284, 3: 71–75 mm. Negros: SU 27353, 7: 50.5–98 mm. Dumaguete, BPBM 26513, 82 mm; BPBM 28579, 81 mm; SU 53318, 3: 53.5–93 mm. Mindoro: Galera Bay, USNM 171267, 2: 43–73 mm; USNM 171293, 3: 42–80 mm. Marinduque: Santa Cruz Island, USNM 171285, 2: 45–51 mm. Luzon: Batangas, USNM 171272, 6: 42–93 mm. Hong Kong: BMNH 1856.11.17.73, 67 mm. Taiwan: BPBM 23388, 32 mm. Papua New Guinea: southeast New Guinea, AMS I.266, 95.5 mm. Port Moresby, AMS I.17537-003, 3: 88.5–92 mm; BPBM 15921, 94 mm (invalid neotype of *Apogon fleurieu,* see Remarks, under *A. fleurieu*); BPBM 30648, 7: 85–92 mm. Madang, AMS I.17086-008, 2: 55–65 mm; BMNH 1974.5.25.1608–1609, 2: 52–63 mm; USNM 212426-27, 8: 30.5–62 mm. Queensland: Great Barrier Reef, Palm Island, ANSP 122321, 80 mm. One Tree Island, AMS I.20206-006, 3: 53–60.5 mm. New South Wales: Sydney Harbor,

AMS I.16777.001, 57 mm; AMS I.17734-001, AMS I.18850-004, 47.5 mm; ANSP 135507, 5: 52–61 mm.

Apogon fleurieu (Lacepède)
Figs. 1, 5–7; Tables 1, 3

Ostorhinchus fleurieu Lacepède, 1801:pl. 32, fig. 2; 1802:23 (type locality, Pacific Ocean).

Apogon annularis var. *roseipinnis* (non Cuvier) Günther, 1859:239 (in part) (Ambon).

Apogon annularis (non Rüppell) Klunzinger, 1870:713 (Red Sea).

Apogon aureus (non Lacepède) Day, 1875: 61, pl. 16, fig. 8 (Madras, India).—Randall, 1983:63, fig. 82 (Red Sea).—Allen & Steene, 1987:pl. 55, figs. 1, 2 (Similan Islands, Andaman Sea).

Apogon (*Amia*) *aureus* (non Lacepède) Klunzinger, 1884:22 (Quseir, Egypt).—Botros, 1971:296 (Red Sea).

Ostorhynchus fleurieu Smith, 1961:399 (in part).—Kotthaus, 1970:62, figs. 245, 246, 250 (southern Red Sea).

Apogon (*Nectamia*) *fleurieu* Dor, 1984:112 (Red Sea).—Kuronuma & Abe, 1986:99, pl. 10 (Persian Gulf).

Apogon (*Ostorhinchus*) *fleurieu* Gon, 1987: 140 (in part).

Apogon sp. Allen & Steene, 1987:pl. 35, fig. 5 (Phuket, Thailand).

Diagnosis.—A species of the genus *Apogon,* subgenus *Ostorhinchus,* with dorsal rays VII–I,9, pectoral rays 14 (rarely 13 or 15); lateral-line scales 24; median predorsal scales 5; gillrakers 19–23; preopercular ridge smooth, the posterior margin and most of ventral margin serrate; body depth 2.4–2.85 in SL; interorbital space 4.05–4.6 in head; posterior nostril usually only slightly larger than anterior; pale (coppery with iridescence in life), the young with a blackish spot midlaterally on posterior caudal peduncle which expands to a broad blackish bar in adults (dark bar not distinctly broader dorsally and ventrally); a broad blackish stripe from front of snout to orbit and continuing diffusely behind eye (stripe bordered above and below by a blue line in life); a narrow brown streak (blue in life) on maxilla and a short distance posterior to it; a small blackish spot on each lateral-line scale (may be faint or absent posteriorly); a line of dark brown dashes basally in anal fin. Maximum size about 105 mm SL.

Description.—Dorsal rays VII–I,9, all rays branched, the last to base; anal rays II,8, all rays branched, the last to base; pectoral rays 14 (rarely 13 or 15); the upper two and lower two or three unbranched; pelvic rays I,5; principal caudal rays 17, the upper and lower unbranched; upper and lower procurrent caudal rays 7–8, the posterior two segmented; lateral-line scales 24; scales above lateral line to origin of dorsal fin 2; scales below lateral line to origin of anal fin 6; median predorsal scales 5, the fourth and fifth deeply indented posteriorly in median line; circumpeduncular scales 12; gillrakers 5–6 (rarely 7)+15–16 (rarely 14 or 17), 1–2 upper and 0–1 lower as rudiments, the total count 19–23; pseudobranchial filaments increasing in number with size from 17 in 29 mm specimen to 29 in 102 mm specimen; branchiostegal rays 7; predorsal bones 3; vertebrae 10+14.

Body moderately deep, the depth 2.4–2.85 in SL, and compressed, the width 2.15–2.5 in depth; head length 2.35–2.5 in SL; dorsal profile of head straight except for rounded front of snout; snout length 4.15–4.65 in head; eye large, the orbit diameter 2.55–3.1 in head; interorbital space flat to slightly convex with median and lateral longitudinal ridges, the width 4.05–4.6 in head; caudal peduncle depth 2.35–2.7 in head; caudal peduncle length 1.7–2.0 in head.

Mouth large, the maxilla reaching to or posterior to a vertical at rear edge of pupil, the upper jaw length 1.9–2.1 in head; mouth oblique, forming an angle of about 35° to horizontal axis of head and body; posterior edge of maxilla slightly rounded to slightly

concave, the corners rounded; supramaxilla not present.

Dentition, nostrils, pores, and scales essentially as described for *Apogon aureus*.

A single, poorly developed, flat, opercular spine at level of upper edge of pupil, the dorsal and ventral margins of the spine forming an angle of 90° or more at the tip; preopercular ridge smooth; posterior margin and most of ventral margin of preopercle serrate (28 serrae on 29 mm specimen and 94 on a 96 mm fish).

Origin of first dorsal fin above base of third lateral-line scale; first dorsal spine slender and short, about one-third length of second spine; second dorsal spine 3.45–4.4 in head; third or fourth dorsal spine longest, 1.8–2.1 in head; first dorsal soft ray longest, 1.45–1.6 in head; origin of anal fin below base of third dorsal soft ray; first anal spine very small, 3.25–3.85 in length of second anal spine; second anal spine 2.45–2.75 in head; first anal soft ray longest, 1.6–1.75 in head; caudal fin forked, the caudal concavity 3.5–4.15 in head, the fin length 2.95–3.1 in SL; third or fourth pectoral rays longest, 1.45–1.6 in head; pelvic fin tips reaching posterior to anus but not beyond origin of anal fin, the first soft ray longest, 1.55–1.75 in head.

Color of adults in alcohol light brown with a dark brown bar about three-fourths orbit diameter in width posteriorly on caudal peduncle, the upper and lower edges of bar not broader than central part; a dark brown stripe from front of snout, broadening as it passes to orbit, and continuing diffusely a short distance behind eye; a dark brown streak usually present on side of maxilla of adults which extends diagonally downward behind end of maxilla; tubular anterior nostril pale; a small dark brown spot on underside of each lateral-line scale, the spots progressively smaller and less pigmented posteriorly; edge of eye dark brown except ventrally; dorsal fins pale or slightly dusky anteriorly, particularly the first dorsal fin; anal fin pale, the leading edge sometimes dusky, with a narrow dark brown line of dashes at base which diverges outward from midbase to end in a streak on last ray; caudal fin usually with some dusky pigment proximally on upper and lower edges; paired fins pale except for a dusky lateral edge on pelvics; peritoneum pale; digestive tract black; gillrakers dusky. Some specimens largely silvery over lower opercle, subopercle, thorax and ventral part of abdomen.

Juveniles of about 30 mm SL are pale with a round diffuse dark brown spot midlaterally on posterior part of caudal peduncle about the size of pupil or slightly larger; the dark stripe on the side of the snout is only faintly developed. With growth the peduncle spot gradually expands dorsally and ventrally to form the bar typical of adults (this attained at a SL of about 75 to 80 mm); the stripe on the head becomes more darkly pigmented, and the dark spots along the lateral line develop and become progressively darker.

Color in life coppery with iridescence, becoming golden on side of body and postorbital part of head; peduncular spot of juveniles and bar of adults black; edges of blackish stripe on head bright blue, these margins often breaking into dashes or spots posterior to eye; occasional individuals with a few blue spots anteriorly on side of body; a bright blue line on side of maxilla and a short distance beyond; lower edge of eye orange; median fins pale salmon, more of this color on rays than membranes, the leading edges of dorsal and anal fins and proximal upper and lower edges of caudal fin slightly dusky; an orange line at base of anal fin (broader posteriorly), separated from an outer adjacent blue line by a row of blackish dashes, one per membrane; pectoral fins pale salmon; pelvic fins with pale yellowish membranes and light orange rays, a narrow dusky leading edge and orange submarginal band.

Remarks.—*Apogon fleurieu* shares many characters with *A. aureus*: essentially the same body and fin proportions (compare

Fig. 5. Adult of *Apogon fleurieu,* BPBM 19811, 96 mm SL, Gulf of Aqaba, Red Sea.

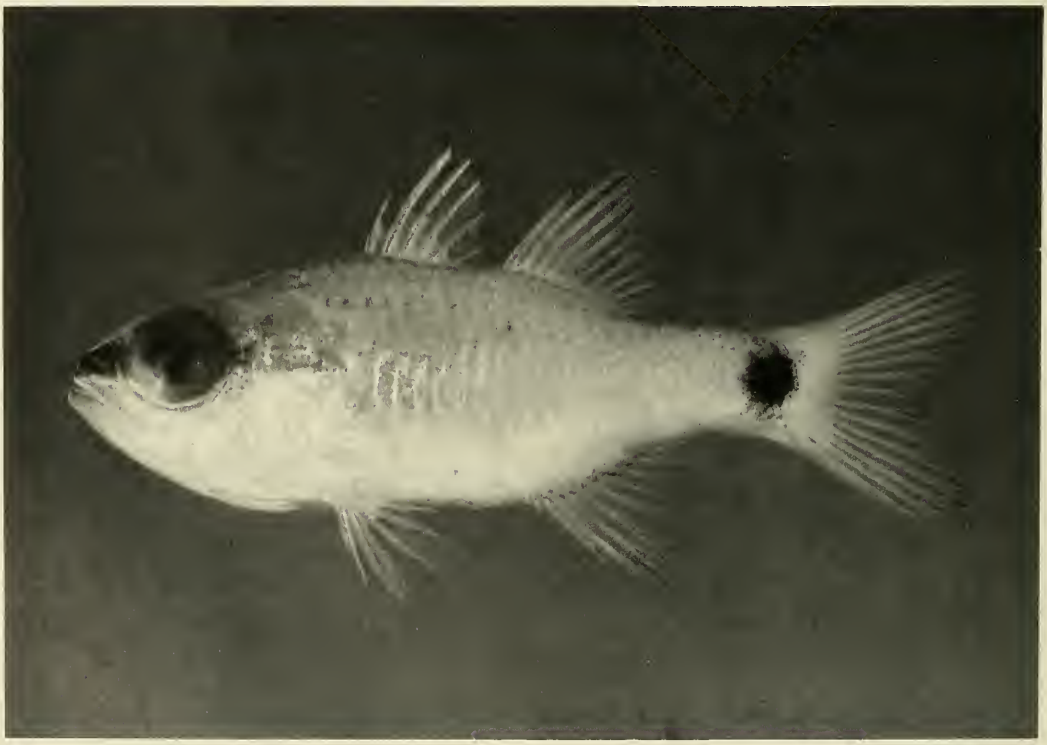

Fig. 6. Juvenile of *Apogon fleurieu,* BPBM 18258, 33 mm SL, Gulf of Aqaba, Red Sea.

Fig. 7. Underwater photograph of *Apogon fleurieu,* about 100 mm TL, Gulf of Aqaba, Red Sea.

Tables 2 and 3), meristic data except gillraker counts, relatively large size, and such color features as the coppery-golden ground color, black peduncular bar in adults, blue-edged blackish stripe on head; blue line on maxilla, row of blackish spots along lateral line, row of dark dashes basally in the anal fin, dusky leading edges of dorsal, anal, and pelvic fins, and dusky proximal upper and lower edges of the caudal fin.

The two species differ in gillraker counts (19–23 for *fleurieu,* compared to 22–27 for *aureus*) and the nature of the dark peduncular marking. Juveniles of *aureus* have a solid bar across the posterior part of the caudal peduncle (Fig. 3) in contrast to a diffuse dark spot for *fleurieu* (Fig. 6). The dark peduncular bar of *aureus* is sharply defined and usually expanded dorsally and ventrally to form a slight hourglass shape. The bar of adult *fleurieu* is not as well defined, is slightly broader laterally than that of *aureus,* and lacks the expanded upper and lower parts usually seen on *aureus.*

There appears to be a difference in the maximum size attained by these two cardinalfishes. *A. aureus* often exceeds 90 mm SL, the largest reported, 121 mm SL (RUSI 12345, from off Durban). Only 28 specimens of *fleurieu* of 423 examined exceed 90 mm SL, the largest, BPBM 31874, 102 mm SL, from the northern end of the Gulf of Aqaba. A specimen of 98 mm SL taken in the Persian Gulf was lost in shipment to the Bishop Museum, but a color photograph of it is on file at the Museum.

Two specimens of *A. fleurieu* from Hong Kong (SU 60820, 61–62 mm SL) and two from off Somalia (USNM 212415, both 63 mm SL) are fully mature females.

Apogon fleurieu is known from the Red Sea, coast of East Africa south to Durban, Seychelles, Persian Gulf, India, Sri Lanka, Andaman Sea (Similan Islands and off Bur-

ma), Ambon, southern Malaysia, Hong Kong, and Philippines. Gerald R. Allen sent us an underwater photograph of this species from Flores, Indonesia. As mentioned, all of the collection sites except the Seychelles are on continental shelves (if the islands of Indonesia and the Philippines may be regarded as on the Asian continental shelf), and the Seychelles are continental in origin.

Six lots of *A. fleurieu* were collected by trawling from the R/V *Anton Bruun,* three off western India (17°41′N–20°N, 70°–71°33′E) in 71–97 m, two off Somalia in 25–31 m, and one in the Andaman Sea at 9°54′N, 97°42′E in 73 m. The shallowest collection of the species was made in 0–7 m off Kovalam, Kerala, southwestern India by the senior author and William F. Smith-Vaniz.

The specimens of *A. fleurieu* from the Seychelles have a higher average number of gillrakers than other localities, and those from the Red Sea have slightly higher counts than other localities (Table 1). Seychelles specimens also attain larger size, in general, than those from other localities. All but five of the twenty-eight specimens which are longer than 90 mm SL were collected from these islands.

Although there are many localities where *Apogon fleurieu* and *A. aureus* seem not to coexist, they do overlap in such localities as East Africa, Seychelles, Sri Lanka, Indonesia, Philippines, and Hong Kong. Both species were collected together at one station in Sri Lanka (USNM 212411 and 212424).

The International Code of Zoological Nomenclature, 3rd Edition, 1985, Article 75, Neotypes, p. 157, (b), Circumstances admitted, states, "A neotype is to be designated only in connection with revisory work, but only in exceptional circumstances. . . ." Article 75, (b)(i), p. 157 states, "The expression 'revisory work' refers to a critical study of the nominal species-group taxon in question, regardless of the scope of the work in which it is published." Other statements of the "Code" not satisfied by the account of Gon (1987) are listed on p. 159, (d), Qualifying conditions, "A neotype is validly designated only when it is published with the following particulars:" (2) "data and description sufficient to ensure recognition of the specimen designated."

Material examined.—Red Sea: Gulf of Aqaba, BPBM 19811, 96 mm; BPBM 18258, 2: 28.5–33 mm; BPBM 31874, 102 mm; HUJ 11321, 62 mm; HUJ 11909, 2: 32.5–55.5 mm; HUJ 11912, 2: 32.5–34.5 mm; HUJ 11920, 2: 33–34 mm; HUJ 11922, 41: 29.5–69 mm; MNHN 1988-689, 2: 38.5–44 mm; NSMT-P.29514, 2: 38.5–43.5 mm; RUSI 3170, 9: 34.5–64.5 mm; RUSI 27672, 2: 37.5–44 mm; USNM 191657, 22: 49–87 mm; USNM 191704, 51: 30–50 mm; WAM P.29707-001, 2: 37–41 mm. Somalia: 11°14–18′N, 51°8′E, USNM 212415, 28: 61.5–82 mm; USNM 212416, 13: 59–82 mm. Kenya: Mombasa, BPBM 27315, 63 mm. Zanzibar: USNM 212405, 86 mm; USNM 212406, 81 mm; USNM 212407, 34: 23–29 mm. Mozambique: Inhaca, RUSI 1733, 9: 29–77 mm; RUSI 1835, 2: 79–83 mm; RUSI 3169, 2: 67–95.5 mm. Delagoa Bay, ANSP 97470, 2: 37–43 mm. Natal: Sodwana Bay, RUSI 9207, 15: 29–46 mm. Madagascar: Nossi Bé, USNM 212408, 2: 59–76 mm. Seychelles: Mahé, ANSP 153774, 91.5 mm; ANSP 153775, 23: 41–101 mm; RUSI 3175, 51 mm; USNM 212409, 75: 34–100 mm. Cosmoledo Group, Assumption Island, RUSI 3176, 44.5 mm. India: off Bombay, USNM 212418, 74 mm; USNM 212419, 3: 77–80.5 mm; USNM 212420, 9: 65.5–75 mm. Kerala, Kovalam, BPBM 27638, 5: 60.5–65.5 mm. Wadge Banks, USNM 212410, 79 mm. Sri Lanka: Trincomalee, USNM 212411-14, 15: 21–77 mm. Andaman Sea: off southern end of Burma, USNM 212421, 10: 52.5–67 mm. Indonesia: Ambon, BMNH 1855.3.24.41, 92 mm. Malaysia: Johore, SU 30409, 90.5 mm. Hong Kong: 22°18′N, 114°23′E, SU 60820, 3: 61–63.5 mm. Philippines: Jolo Island, USNM 171287, 10: 76–89 mm;

USNM 171289, 73 mm. Masbate, Cataingan Bay, USNM 212417, 9: 19–26 mm.

Apogon pselion, new species
Figs. 8, 9; Tables 1, 4

Holotype.—BPBM 21515, male, 36.2 mm, Red Sea, Gulf of Aqaba, Sinai Peninsula, El Himeira, coral knoll, 12 m, rotenone, J. E. Randall and O. Gon, 25 Apr 1977.

Paratypes.—TAU 9670, 26.5 mm, Red Sea, Gulf of Suez, Abu Zneiman, rotenone, L. Fishelson, 22 Sep 1967; TAU 9669, 2: 29.0–30.5 mm, Gulf of Aqaba, Eilat, rotenone, D. Popper, 22 Jan 1969; USNM 213381, 36.0 mm, Gulf of Aqaba, Sinai Peninsula, El Himeira, 0–18 m, rotenone, V. G. Springer et al., 16 Jul 1969; USNM 213382, 2: 33.5–35.5 mm, El Himeira, 8–16 m, V. G. Springer et al., 19 Jul 1969; USNM 213383, 7: 39.3–41.3 mm, Sinai Peninsula, east coast, Ras Burqa, 9–15.5 m, rotenone, V. G. Springer et al., 21 Jul 1969; USNM 213385, 38.0 mm, just north of Ras Burqa, to 11 m, rotenone, V. G. Springer et al., 23 Jul 1969; USNM 213387, 11: 20.6–36.8 mm, El Himeira, 21.5–27.5 m, V. G. Springer et al., 9 Sep 1969; CAS 60679, 2: 24.6–35.7 mm, NSMT-P.44623-24, 2: 24.5–35.1 mm, RUSI 27056, 2: 22.0–34.4 mm, WAM P.29386-001, 2: 25.2–35.0 mm—all with same data as USNM 213387; BPBM 13381, 32.7 mm, Gulf of Aqaba, Eilat, off marine biological laboratory, reef in 43 m, rotenone, J. E. Randall and D. Popper, 6 Jun 1972; BPBM 18261, 6: 23.2–36.9 mm, Sinai Peninsula, east coast, Coral Island, east side, 30 m, quinaldine, J. E. Randall and O. Gon, 24 Sep 1974; BPBM 31988, 6: 33.8–39.6 mm, MNHN 1977-827, 5: 32.5–37.5 mm—both lots with same data as holotype.

Diagnosis.—A species of the genus *Apogon,* subgenus *Ostorhinchus,* with dorsal rays VII–I,9; pectoral rays 13–14 (usually 14); lateral-line scales 24; median predorsal scales 4; gillrakers 19–22; preopercular ridge smooth, the posterior margin and rear half of ventral margin of preopercle serrate; body depth 2.8–3.4 in SL; interorbital space 4.55–5.4 in head; posterior nostril more than twice as large as anterior; four dusky golden yellow stripes on head separated by blue lines, the midlateral stripe passing from snout, through eye, and continuing along side of body as a brassy yellow stripe; a black bar encircling posterior caudal peduncle.

Description.—Dorsal rays VII–I,9, all rays branched, the last to base; anal rays II,8, all rays branched, the last to base; pectoral rays 14(13–14), the upper two and lower three unbranched; pelvic rays I,5; principal caudal rays 17, the upper and lower unbranched; upper and lower procurrent caudal rays 7, the posterior two segmented; lateral-line scales 24 (plus 3 scales posterior to end of hypural plate); scales above lateral line to origin of first dorsal fin 2; scales below lateral line to origin of anal fin 5½; median predorsal scales 4, the fourth scale deeply indented medially on the posterior edge and the third scale slightly indented posteriorly; circumpeduncular scales 12; gillrakers 6+15 (5–6+14–16), 2–3 upper and 0–1 lower as rudiments; pseudobranchial filaments 15 (10–16); branchiostegal rays 7; predorsal bones 3; vertebrae 10+14.

Body moderately elongate, the depth 2.95 (2.8–3.4) in SL, and compressed, the width 2.35 (1.9–2.5) in depth; head length 2.55 (2.45–2.6) in SL; dorsal profile of head straight except for rounded front of snout; snout length 3.85 (3.95–4.3) in head; eye large, the orbit diameter 2.8 (2.5–3.0) in head; interorbital space flat to slightly convex, the width 4.9 (4.55–5.4) in head; caudal peduncle about twice as long as deep, the least depth 2.6 (2.5–3.3) in head.

Mouth large, the maxilla reaching to or slightly posterior to a vertical through rear edge of pupil, the upper jaw length 1.95 (1.9–2.05) in head; mouth oblique, forming an angle of about 35° to horizontal axis of head and body; posterior edge of maxilla slightly concave; no supramaxilla present; lower jaw projecting, the tip dorsoventrally thickened;

Fig. 8. Holotype of *Apogon pselion,* BPBM 21515, 36.2 mm SL, Gulf of Aqaba, Red Sea.

villiform teeth in a narrow band in jaws, with two rows at front of upper jaw (except for a gap at symphysis) and about five rows at side of jaw (teeth of inner rows on side of jaw very small); front of lower jaw with about three rows of teeth narrowing to one at side of jaw; a single irregular row of very small teeth forming a V on vomer; a single row of very small teeth on palatines; tongue broad at base tapering to lanceolate form with expanded rounded tip.

Anterior nostril a short membranous tube directly anterior to center of eye half the distance to front of snout; posterior nostril ovate without a raised rim, its largest diameter two or more times greater than diameter of anterior nostril, located dorsoposterior to anterior nostril closer to edge of orbit than anterior nostril; numerous small pores readily visible dorsally on head, scattered over surface of preopercle and along its anterior margin, on suborbital rim, and mandible.

A single, poorly developed, flat opercular spine, its tip forming an angle slightly greater than 90°; posterior margin of preopercle serrate (33 serrae on holotype), the serrae smaller on upper margin than the broadly rounded corner; lower margin of preopercle serrate about half distance from middle of rounded corner to end of free edge; preopercular ridge not serrate.

Lateral line conspicuous, very slightly arched anteriorly, then paralleling dorsal contour of body and ending midlaterally a short distance posterior to caudal-fin base (three pored scales posterior to end of hypural); scales weakly ctenoid; head naked except operculum and nape; no scales on fins except for a low sheath at extreme base of dorsal and anal fins and small scales on base of caudal fin which extend at most half distance to posterior margin.

Origin of first dorsal fin above base of third lateral-line scale; first dorsal spine slender and short, about one-fourth length of second spine, 11.9 (9.8–14.5) in head; third dorsal spine longest, 2.1 (1.9–2.15) in

Fig. 9. Underwater photograph of *Apogon pselion*, about 40 mm TL, Eilat, Gulf of Aqaba, Red Sea.

head; first dorsal soft ray longest, 1.6 (1.5–1.65) in head; origin of anal fin below base of second dorsal soft ray; first anal spine small, about one-third length of second anal spine, 8.35 (7.3–10.7) in head; second anal spine 3.0 (2.45–2.95) in head; first anal soft ray longest, 1.9 (1.7–1.9) in head; caudal fin forked, its length 3.2 (3.1–3.6) in SL, the caudal concavity 4.7 (4.1–4.9) in head; third and fourth pectoral rays longest, 1.55 (1.5–1.75) in head; first and second pelvic rays longest, 1.75 (1.65–1.85) in head.

Color of holotype in alcohol: pale with a black bar encircling posterior caudal peduncle and extending slightly onto caudal-fin base, this bar widest on side of peduncle (bar width about half orbit diameter); a very diffuse and faint dusky midlateral stripe on body; a narrow dusky stripe from front of upper lip to middle of front edge of orbit; a narrow dusky stripe from front of lower jaw to lower edge of eye and merging with broad dusky area on side of postorbital head; fins pale except for a dusky stripe near base of second dorsal and anal fins; peritoneum pale to slightly dusky; digestive tract black.

Color of holotype when fresh: body pale pinkish gray, overlaid with iridescent bluish silver ventrally, with a midlateral brassy yellow stripe faintly edged in pale iridescent blue, and a black bar encircling posterior caudal peduncle and adjacent caudal-fin base; head with four dusky golden yellow stripes separated by pale blue lines; median fins transparent bluish, the rays edged in pale salmon, the second dorsal and anal fins with a pale blue-edged dusky light orange band near base; paired fins transparent with pale salmon rays.

Remarks.—This species is given the specific name *pselion* from the Greek noun for bracelet or anklet, in reference to its most distinctive color marking, the ring of black around the posterior caudal peduncle.

Apogon pselion coexists in the northern Red Sea with the related *A. fleurieu.* The former is a much smaller species (the largest specimen 41.3 mm SL). At this size *A. fleurieu* has a diffuse dark spot posteriorly on the side of the peduncle whereas *A. pselion* at all sizes represented by our material has a solid black bar. *A. pselion* could be confused by its color pattern in preservative with the young of *A. aureus* (though the latter is not known from the Red Sea), which already has a completely formed black peduncular bar at sizes as small as 33 mm SL. Most specimens of these two species can be distinguished by gillraker counts (see Table 1).

Apogon pselion may be differentiated from both *aureus* and *fleurieu* by its more elongate body (the depth 2.8–3.4 in SL, compared to 2.25–2.85 for the other two species), narrower interorbital space (4.55–5.4 in head, compared to 4.05–4.6 for the other two species), shorter fins, in general (compare Tables 2–4), three instead of four lateral-line scales posterior to end of hypural plate, and life color. *A. aureus* and *A. fleurieu* lack the four yellow stripes on the head and lateral yellow stripe on the body, and *A. pselion* lacks the series of small dark spots along the lateral line.

Apogon pselion is at present known only from the Gulfs of Aqaba and Suez; it may be confined to the northern Red Sea where the water temperature is distinctly cooler than the central and southern part of the Sea. No specimens have been collected in rotenone stations from the Red Sea coasts of Sudan, Ethiopia, or Saudi Arabia. The type material has been obtained from reefs in the depth range of about 10 to 43 m.

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(JER) Bishop Museum, Box 19000-A, Honolulu, Hawaii 96817-0916; (THF) Environmental Quality Laboratory, 1009 Tamiami Trail, Port Charlotte, Florida 33952; (EAL) Dept. Vertebrate Zoology (Fishes), National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.